EXHIBIT B

# Proposed Study of Environmental Effects Resulting from Discharge of Chlorinated Hydrocarbons and Increased TDS Load from Gary Works Blast-Furnace Alkaline-Chlorination System

Summary:

In relation to the NPDES settlement for Gary Works, U. S. Steel has proposed a research program to determine the environmental effects of the effluent from the future blast-furnace wastewater-treatment system. The program includes operation of a pilot plant at South Works and Gary to simulate the proposed process and to generate a treated effluent for extensive fish-toxicity tests. It is estimated that the cost of this program will be approximately $500,000.

## Background

As part of the NPDES program for Gary Works, U. S. Steel has agreed to install a recycle system for the blast-furnace process water with treatment of the necessary blowdown from this system for contaminant removal prior to discharge to the Grand Calumet River.

This process basically consists of alkaline chlorination followed by activated carbon adsorption. The alkaline-chlorination step contemplated will utilize pH adjustment by caustic soda, then reaction with chlorine in two stages to accomplish removal of ammonia, phenol, and cyanide, which are the main blast-furnace wastewater parameters of concern. The activated carbon-treatment step is intended to provide dechlorination of any residual chlorine and also to remove by adsorption, undesirable by-products such as chlorinated organics that might result from the chlorination steps.

The described treatment system for blast-furnace recycle-blowdown water has not been demonstrated in long-term operation on a large blast-furnace system such as at Gary Works. Specifically, the planned treatment system has two points for study: (1) the potential for formation of chlorinated organics, and (2) the level of dissolved solids (TDS) that can result.

An extended research study was developed through negotiations and consists of operation of a pilot blast-furnace blowdown-treatment system of the type specified for Gary Works to generate a treated waste stream for studies of contaminant compositions, TDS loads, and fish-toxicity potential. Details of the proposed research study are as follows.

I. Pilot Plant at South Works

To develop the required design information for the Gary Works blast-furnace blowdown-treatment system, U. S. Steel has installed and is operating a pilot alkaline-chlorination activated-carbon unit. This unit was installed at U. S. Steel's South Works in Chicago since there is a tight blast-furnace recycle system in operation at that plant, which can supply the recycle water needed for the test program. Test work using the pilot unit will be conducted for a sufficient period of time to obtain necessary design information for Gary such as alkali and chlorine usage rates, reactor sizes, method of chlorine dosage control, activated carbon-type and usage rate, number and size of carbon columns, and method of regeneration of the spent carbon. Detailed engineering, equipment procurement and construction of the treatment system at Gary will begin after the pilot-design data have been obtained.

Starting in April 1978, operation of the pilot plant at South Works will be resumed to facilitate the proposed study of the effluent characteristics and impact on the aquatic life in the receiving waters.

Purpose of Pilot Operation - To generate treated waste stream, as representative as possible of the expected future discharge from Gary Works, to enable immediate studies of impact of total dissolved solids and chlorinated organics on receiving waters.

Manpower Requirement - Six men to operate pilot plant around the clock, 7 days per week, plus 2 men per day for analytical work, plus 1 supervisor

Analysis - Daily determination of blast-furnace blowdown and treated effluent for:

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|---|---|
| $NH_3$ | Phenol |
| $CN_A$ | SS |
| $CN_T$ | TDS |
| SCN | Conductivity |
| $CNO^-$ | pH |
| $Cl^-$ | Cl demand (influent only) |
| $SO_4^=$ | Cl residual (effluent only) |
| $F^-$ | |

Length of Operation - Eight weeks to stabilize operation and generate treated effluent for analysis and fish-toxicity tests.

Estimated Cost

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| Manpower plus travel | $120,000 |
| Equipment (Replacement & Maintenance) | 10,000 |
| Total | $130,000 |

II. Analysis for Residual Organic Chemicals at South Works

A sample of the influent to the activated carbon columns will be taken before July 1, 1977, during the present pilot operation at South Works. The sample will be extensively analyzed by gas chromatographic-mass spectroscopic (GC-MS) techniques to determine quantitatively which organic compounds can be detected as being present in the water after alkaline chlorination but before treatment with activated carbon. A concurrent second sample will be taken of the effluent from the carbon columns and analyzed for the compounds detected in the first sample. The analysis will be made by Calgon Corporation. The opportunity will be made for U.S. EPA to obtain split samples. The results of the analyses will be reported to the Environmental Protection Agency by September 1, 1977 and the raw data and chromatograms will be made available to EPA.

During the operation of the pilot plant at South Works to generate treated water for fish tests, selected samples of influent to the carbon columns will be given a complete analysis for organic compounds and the effluent to the biotesting will be analyzed for compounds found in the influent. Analysis, also by GC-MS, will be made on selected organisms at the end of the fish toxicity and embryo and larval exposure tests for indication of bioaccumulation of organics in tissue. Analyses will be done under contract with a contractor, which will be selected by mutual agreement between U.S. EPA and U. S. Steel Corporation or may be done by U. S. Steel with prior agreement by U.S. EPA as to procedures.

During the pilot plant operations commencing in April 1978, U.S. EPA may obtain samples of water prior to alkaline chlorination, prior to carbon adsorption and after carbon adsorption for separate agency-sponsored analyses.

Frequency of Analysis - To be determined in conjunction with the selected fish toxicity consultant.

Cost - Estimated at $2000 per sample for complete analysis and $500 per sample for predetermined compounds. The estimated total cost is $30,000.

III. Fish-Toxicity Tests at South Works

Purpose - To determine whether the effluent from an alkaline chlorination treatment system has potential for toxicity to aquatic life at the point of discharge to the receiving water body.

Method - It is proposed to conduct a flow-through acute fish toxicity study, with three selected species, and embryo-larva toxicity test with one species and a qualitative screening test for bioaccumulation of toxicants. This testing program on the effluent from the pilot operation at South Works will begin on or about April 1, 1978, and will require four to five weeks of continued testing. A report of the results of fish toxicity and chemical analysis will be submitted by August 1, 1978. The contractor-consultant will be selected by U. S. Steel Corporation with the consent of the U. S. EPA. U. S. Steel will obtain the prior approval of U. S. EPA of any test procedures used for these toxicity studies.

Cost - The cost for the toxicity testing is estimated at $35,000.

IV. Gary Blast-Furnace Outfall Monitoring

Concurrently with the pilot-plant study, extensive monitoring of the Gary Works blast-furnace process-water outfall will be conducted to obtain base-lined water quality. The purpose will be to determine contaminant concentrations and variations to aid in projecting the future load of TDS from Gary, and also to determine any potential differences between the contaminant loadings from the Gary and South Works blast furnaces, which might necessitate adjustments in the pilot operation to ensure that the results will be representative of those to be expected in the Gary treatment system.

Analyses for flow, TDS, CN, $NH_3$, SCN, phenol, $SO_4^=$ $Cl^-$, and $F^-$ are already being conducted routinely by plant personnel for most of the specified parameters.

V. Pilot Plant at Gary Works

The compliance schedule for Gary Works specifies attainment of operational level of the blast-furnace recycle system by October 1, 1979. Accordingly, by November 1, 1979, it is

proposed to begin operation of the alkaline chlorination activated carbon pilot plant on the Gary blowdown stream. The analytical determinations of the waste loadings and the fish-toxicity tests will then be repeated, using the discharge water from the actual Gary system, to confirm results obtained at South Works. Operation at Gary on the actual water of concern is considered essential to account for any differences in blast-furnace raw materials and operating practices between South and Gary. The fish-toxicity tests will start on March 1, 1980, after a period to stabilize operation of the pilot plant on Gary blowdown water, and will require four to five weeks of continual testing. A final report on the results of the pilot plant study at Gary Works will be submitted to U. S. EPA by September 1, 1980.

Manpower Requirement - Six men to operate pilot plant around the clock, 7 days per week, plus 2 men per day for analytical work, plus 1 supervisor.

Analysis - Daily determinations as previously described under I.

Length of Operation - Three weeks for initial stabilization followed by eight weeks during fish-toxicity test period.

Estimated Cost

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| Manpower plus travel and lodging | $179,000 |
| Installation and equipment | 10,000 |
| Total | $189,000 |

VI. Analysis for Residual Organic Chemicals at Gary Works

Procedure similar to that described previously for South Works. Assume 10 percent cost escalation.

Cost - $33,000

VII. Fish-Toxicity Tests at Gary Works

Procedure similar to that described previously for South Works. Assume 10 percent cost escalation.

Cost - $38,000

## ..al Cost

Allowing a 10 percent contingency for unexpected problems, it is estimated that the cost of the described research study program will be approximately $500,000, including manpower and materials for pilot-plant operation at South Works and Gary, analytical services, and fish-toxicity tests. The program is expected to extend to about mid-1980.

### Summary of Estimated Cost of Proposed Research Program

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| I. | Pilot Plant at South Works | $130,000 |
| II. | Analysis for Residual Organic Chemicals at South Works | 30,000 |
| III. | Fish-Toxicity Tests at South Works | 35,000 |

An accounting of expenditures will be made after this phase is completed.

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| V. | Pilot Plant at Gary Works | 189,000 |
| VI. | Analysis for Residual Organic Chemicals at Gary Works | 33,000 |
| VII. | Fish-Toxicity Tests at Gary Works | 38,000 |
| IX. | Ten percent contingency for unexpected problems | 45,000 |
| | Total Not to exceed | $500,000 |

A final accounting of expenditures will be made after this last phase is completed. Proper financial accounting records will be maintained to identify the above expenditures.